

## THE DWARF GALAXY DDO 47: TESTING CUSPS HIDING IN TRIAXIAL HALOS

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**Abstract.** We present HI data of the dwarf galaxy DDO 47, aimed at testing the hypothesis that dark halo triaxiality might induce non-circular motions resulting in rotation curves best fitted by cored halos, even if the dark matter halo is intrinsically cuspy. We performed a harmonic decomposition of the velocity field in order to search for alleged non-circular motions needed to “hide” a cusp: in DDO 47 non-circular motions are globally at a level of  $2\text{--}3\text{ km s}^{-1}$ , far from being sufficient to reconcile the observed rotation curve with the  $\Lambda$ CDM predictions. We conclude that the dark matter halo around DDO 47 is truly cored and that a cusp cannot be hidden by non-circular motions. More details are shown in Gentile et al. (2006, ApJL in press, astro-ph/0506538).

### 1 Introduction

A fundamental prediction of the cosmological ( $\Lambda$ ) Cold Dark Matter ( $\Lambda$ CDM) theory is that virialized dark matter halos should have universal density profiles, such as the Navarro, Frenk & White (1996, NFW) halo. These CDM predictions have been confronted with observations, and numerous mass models of spiral, dwarf and LSB galaxies have shown that in a large number of cases the inferred cores of dark matter halos are much shallower than expected from the NFW-fit (e.g., de Blok et al. 2001, Gentile et al. 2004). We have used DDO 47 to explore the possibility that solid-body rotation curves (usually interpreted as a signature of constant density cores) would arise naturally also in NFW halos as a result of a triaxial dark matter mass distribution that hides the steep central density cusp through deviations from axial symmetry in the disk.

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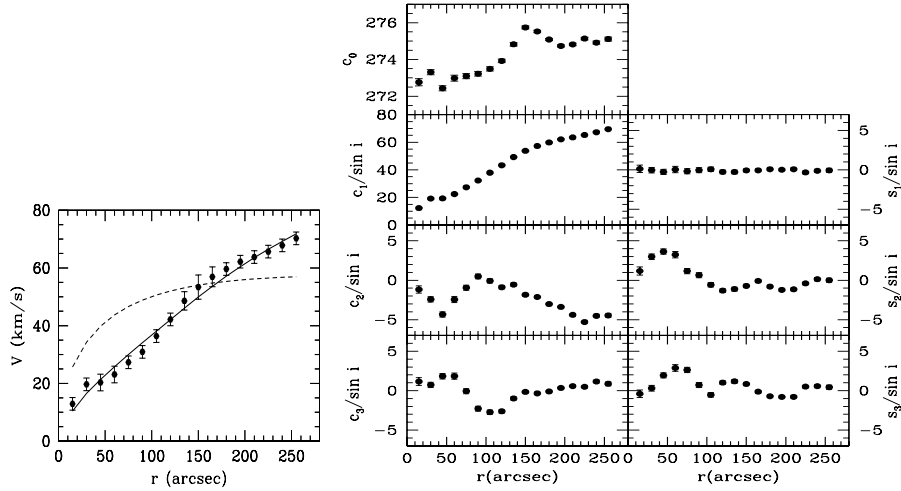
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**Fig. 1.** Left: Mass models for DDO 47: the solid line is the fit with the Burkert halo, and the dotted line is the NFW fit. Right: harmonic decomposition of the velocity field.

## 2 Results

DDO 47 is one of the most clear cases with kinematical properties that are inconsistent with NFW (Fig. 1, left panel).

In order to better investigate the kinematic properties of DDO 47, we have fitted the velocity field in terms of harmonic coefficients (e.g. Schoenmakers, Franx and de Zeeuw 1997), with terms up to third order (Fig. 1, right panel). A global elongation of the potential would cause the  $s_3$  term to be approximately constant and non-zero, while wiggles could be explained by the presence of spiral structure. In DDO 47 the latter case applies, we find no evidence for a global elongation of the potential and the amplitude of the oscillations is much smaller (a factor 5-10) than the discrepancy with the  $\Lambda$ CDM predictions. We can conclude that the non-circular motions in DDO 47 are at a level of at most  $3 \text{ km s}^{-1}$  and that they are not associated with a global elongation of the potential, therefore the dark matter halo around the dwarf galaxy DDO 47 is truly cored and that a cusp cannot be hidden by non-circular motions.

## References

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